

CLAIMS:

- 1 1. A bi-directional pig apparatus for use in a pipeline,
2 the pig comprising:
 - 3 a. a body portion having front and rear end portions
4 and a first principal bore therethrough;
 - 5 b. a plurality of thruster ports extending through
6 the body portion for allowing fluid to flow through the plurality
7 of thruster ports in a first direction under a first fluid
8 pressure and in a second direction under a second fluid pressure;
 - 9 c. means within each thruster port for reacting to
10 fluid pressure to allow fluid flow through the thruster ports.
- 1 2. The apparatus in claim 1, wherein there are provided
2 at least six thruster ports in the apparatus.
- 1 3. The apparatus in claim 1, wherein the means within each
2 thruster port reacting to fluid pressure further comprises a
3 first thruster spring and a second reverse thruster spring for
4 controlling the flow through the ports.
- 1 4. The apparatus in claim 3, wherein the first thruster
2 spring is compressible at around 450 lbs./in. of pressure.
- 1 5. The apparatus in claim 3, wherein the reverse thruster
2 spring is compressible at around 150 lbs./sq. in. of pressure.
3
- 4 6. The apparatus in claim 3, wherein compression of the
5 first thruster spring allows first fluid flow through the
6 plurality of thruster ports from the rear of the pig to contact
7 material ahead of the pig as the pig is moved along the pipeline
8 under pressure.
- 9 7. The apparatus in claim 3, wherein compression of the

10 reverse thruster spring allows fluid flow through the thruster
11 ports from the front of the pig returning to the rear of the pig
12 a certain fluid pressure.

1 8. The apparatus in claim 1, wherein the apparatus is
2 secured to the end of coiled tubing.

1 9. The apparatus in claim 1, wherein the apparatus is
2 secured to at least one knuckle joint and hydraulic release
3 mechanism.

1 10. The apparatus in claim 1, wherein further comprising
2 at least three flexible cups equally spaced apart along the outer
3 wall of the pig body to contact an inner wall of the pipeline.

1 11. The apparatus in claim 1, wherein the plurality of
2 thruster ports impart a pressurized fluid flow through thruster
3 nozzles, three nozzles emitting fluid ahead of the pig, and three
4 nozzles emitting fluid in a direction against the wall of the
5 pipeline adjacent the pig.

1 12. The apparatus in claim 1, further comprising
2 compressible rings between each of the cups which would compress
3 under excess pressure within the pipeline to reduce the pressure
4 buildup.

1 13. A bi-directional pig apparatus secured to the end of
2 coiled tubing within a pipeline, the apparatus comprising:

3 a. a body portion having front and rear end portions
4 and a first principal bore therethrough;

5 b. a plurality of thruster ports extending through
6 the body portion;

7 c. means for allowing fluid to flow through the plurality

8 of thruster ports in a first direction under a certain fluid
9 pressure, and in a second direction under a second fluid
10 pressure;

11 d. a plurality of cups extending outward from the
12 body portion to a distance equal to the inner diameter of the
13 pipeline; and

14 e. a first fluid flow through the plurality of
15 thruster ports from the rear of the pig to contact material ahead
16 of the pig as the pig is moved along the pipeline under pressure;

17 f. second fluid flow from the front of the pig
18 returning to the rear of the pig through the first principal
19 bore, the fluid carrying debris contacted by the first fluid
20 flow.

1 14. The apparatus in claim 13, wherein the apparatus is
2 secured to a pair of knuckle joints for allowing the pig to
3 maneuver through turns in the pipeline.

1 15. The apparatus in claim 13, wherein the apparatus is
2 secured to hydraulic release mechanism to allow release of the
3 apparatus from the coiled tubing.

1 16. The apparatus in claim 13, wherein there are provided
2 at least six thruster ports in the apparatus.

1 17. The apparatus in claim 13, wherein each thruster port
2 further comprises a first thruster spring and a second reverse
3 thruster spring for controlling the flow through the ports.

1 18. The apparatus in claim 13, wherein the first thruster
2 spring is compressible at around 450 lbs./in. of pressure.

1 19. The apparatus in claim 13, wherein the reverse thruster
2 spring is compressible at around 150 lbs./sq. in. of pressure.

1 20. A method of cleaning a pipeline, comprising the
2 following steps:

3 a. providing a pig apparatus secured to the end of
4 a length of coiled tubing in the pipeline;

5 b. injecting fluid under pressure into the pipeline
6 behind the pig to impart forward movement of the pig in the
7 pipeline;

8 c. increasing the fluid pressure behind the pig at
9 a predetermined point so as to open thruster ports within the pig
10 body and allow multiple streams of fluid to flow through the
11 ports and be emitted through a front end of the pig;

12 d. circulating the emitted fluid back through the pig
13 body, up the coiled tubing to the surface, so that the
14 recirculated fluid carries any pieces of debris dislodged from
15 the pipeline by the emitted fluid flow.

1 21. The method in claim 20, further comprising the step of
2 retrieving the pig from down the pipeline by flowing fluid under
3 pressure down the bore of the coiled tubing and, under a
4 predetermined pressure, to open the thruster ports in the
5 opposite direction so that the fluid flowing through the coiled
6 tubing bore is returned to the point behind the pig through the
7 thruster ports.

1 22. The method in claim 20, wherein the thruster ports are
2 opened by fluid pressure acting on a thruster spring at a force
3 of around 450 lbs./sq. in.

1 23. The method in claim 20, wherein the thruster ports are
2 opened in the opposite direction by fluid force acting a second
3 reverse thruster springs at a force of around 150 lbs./sq. in.